

REMARKS

No claims have been amended. Claims 2-34 remain pending.

Rejections under 35 U.S.C. §§ 102 and 103

Claims 2-4, 7, 8, 10-13, 17, 18 and 27-30 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,412,276 to Salvat et al. (hereafter “Salvat”). Claims 30 and 32-34 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,901,747 to Tashiro et al. (hereafter “Tashiro”). Claims 5, 6, 19 and 31 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Salvat in view of U.S. Patent No. 4,685,290 to Kamiya et al. (hereafter “Kamiya”). Claims 9, 14-16, 20, 21 and 26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Salvat in view of U.S. Patent No. 6,804,952 to Sasaki et al. (hereafter “Sasaki”). Claims 22-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Salvat in view of U.S. Patent No. 6,796,118 to Kitahara (hereafter “Kitahara”). Applicant respectfully traverses these rejections for at least the following reasons.

Independent claim 2 recites “wherein the combustion controlling actuator includes a fuel injector to inject fuel directly into a combustion chamber of the engine; and the controller is configured to perform a preliminary fuel injection to produce the preliminary combustion at or near top dead center, and to perform a main fuel injection to start the main combustion after the preliminary combustion is finished.” Thus, in claim 2, the preliminary fuel injection is performed at or near top dead center, and the main combustion is controlled to start after a preliminary combustion has finished. Salvat, which is relied on for disclosing the features of claim 2, fails to disclose this combination of features where the preliminary fuel injection is performed at or near top dead center.

Salvat discloses a regeneration system for regenerating a particulate filter 4 for a diesel engine. Salvat discloses a phase in which the engine is operated without assisted regeneration in FIG. 2, where the fuel is injected in two stages, a pilot injection I1 and a main injection I2 (col. 2, lines 56-60). Salvat also discloses a phase in which the engine is operated

with assisted regeneration of the filter in FIG. 3, where the fuel is injected in three stages, I'1 to I'3.

Assuming for the sake of argument that the injection stages of Salvat could be considered to be a preliminary combustion followed by a main combustion after the end of a preliminary combustion, Salvat still does not disclose all the features of claim 2. Nowhere does Salvat disclose that a preliminary combustion should be produced at or near the top dead center. The objective of the injections in Salvat is to prolong combustion as long as possible (column 2, lines 61-67), but nowhere does Salvat suggest that a preliminary combustion should be produced at or near the top dead center. Salvat is not concerned with this feature of claim 2.

The Office Action states on page 13:

With regards to the Applicant's argument that Salvat does not teach to produce the main combustion at or near top dead center, the Examiner has interpreted the combustion depicted by I'3 of Figure 3 as the main combustion, and points to Line 28 of Column 3 for the range of crank angles where this combustion can take place, and particularly 15° which is reasonably construed as near top dead center.

As an initial matter, applicant notes that claim 2 recites "produce the preliminary combustion at or near top dead center," not that the main combustion is produced at or near top dead center.

Moreover, Salvat does not disclose producing a preliminary combustion at or near top dead center. Salvat merely discloses in col. 3, line 28 of Salvat, cited in the Office Action, that there is an angular shift between the earlier injection I'2 and the latter injection I'3 of from 15 to 150°, and does not disclose an absolute value of the crank angle for either the I'2 injection or the I'3 injection. Salvat does not disclose that the earlier injection I'2 occurs at a crank angle of 15°, whether or not 15° could be considered to be near top dead center. Accordingly, Salvat does not disclose producing a preliminary combustion at or near top dead center.

The remaining references of Kamiya, Sasaki, and Kitahara were cited for other features of the claims, but fail to cure the deficiencies of Salvat.

Independent claims 30 and 32, respectively recite “controlling fuel injection to start main combustion after an end of the preliminary combustion in the engine cycle” and “means for controlling fuel injection to the engine in a split combustion mode in response to the split combustion request by controlling fuel injection to produce preliminary combustion and controlling fuel injection to start main combustion after an end of the preliminary combustion.” Thus, both independent claims 30 and 32 recite that the main combustion is started “after an end of the preliminary combustion.” Tashiro, which is relied on for disclosing this feature of claims 30 and 32, fails to disclose controlling fuel injection to start main combustion after an end of the preliminary combustion in the context of claims 30 and 32.

Tashiro merely suggests continuous combustion between a pilot injection or subinjection and a main injection, and thus does not disclose or suggest controlling fuel injection to start main combustion after an end of the preliminary combustion, as recited in claims 30 and 32. Tashiro discloses making a pilot injection (Fp) near the top dead center (TDC) (column 4, lines 3-11). The pilot injection, however, is continuous with the main injection. The purpose of the pilot injection in Tashiro is to provide “a kindling charcoal, so that the fuel of the main injection burns securely” (col. 4, lines 9-11). Moreover, “by fixing this timing tp of the pilot injection Fp, the fuel of the pilot injection Fp can be burned securely near the top dead center where the pressure and the temperature are always high facilitating the fuel combustion, and the fuel of the main injection Fm can ignite before the temperature decreases, by securing the kindling charcoal (col. 15, lines 62-67).” Thus, the fuel injection control system in Tashiro is designed to perform a sub injection before a main injection and to sustain the combustion flame of the sub injection until the injection timing of the main injection (column 8, lines 36-44). The fuel injection control method of Tashiro is based on the premise that the main injection is performed before the end of the preliminary fuel injection (Fp) to prevent misfire of the main injection even if the main injection in Tashiro retarded. Thus, Tashiro does not disclose or suggest controlling fuel injection to start main combustion after an end of the preliminary combustion, as recited in claims 30 and 32.

The dependent claims are patentable for at least the same reasons as their respective independent claims, as well as for further patentable features recited therein.

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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